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(54) Thermally insulating, soundproofing, and shock-absorbing modular panel, and method for manufacturing the panel

(57) An insulating modular panel (1) featuring quick installation, particularly for house, civil, and industrial building, includes a main body (2) formed by at least one layer of cuttings made of rubber, rubber-cork, and/or foamed clay and/or similar materials, and substantially flat faces (3) and substantially straight peripheral edges (4) for mutual coupling with other adjacent co-planar panels (1') of the same type. The peripheral edges (4) have a connecting means (5) that is suitable to prevent the mutual spacing of the panels (1,1') on their common plane of arrangement. Another aspect of the invention relates to a method for producing panels of the above mentioned type.

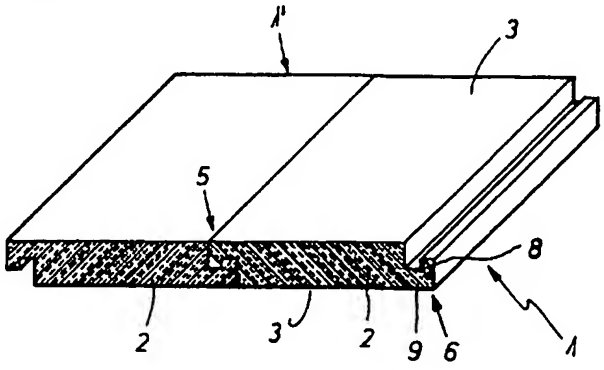

FIG. 1

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Description

The present invention relates to a soundproofing, thermally insulating, and shock-absorbing modular panel, particularly having a rubber base, and to a method for manufacturing it.

The field of application of these panels is, particularly but not exclusively, the field of constructions, namely residential and industrial buildings, for the thermal insulation, soundproofing, and shock-absorption of walls, garrets, and floors.

Panels of the above mentioned type are known which are formed by a layer of cuttings made of rubber or of mixtures of rubber and rubber with cork that are aggregated by hot molding.

In order to manufacture insulating coverings, the conventional panels are usually arranged side by side on a supporting surface so that their respective edges are in mutual contact.

A drawback of conventional panels is that they do not ensure stability with respect to the supporting surface, because they can move under the action of mechanical stresses, caused for example by settling of the building, and consequently move mutually apart along their plane of arrangement, because a certain relative play is provided for during installation. This causes wide cracks or gaps to open, causing a significant decrease in the insulating power of the covering.

In order to obviate this drawback, known panels are usually fixed to the supporting surface by glueing or with metal screws and staples.

It is evident that this solution has the drawback of a considerable increase in time and costs for the installation of conventional panels, which is usually performed by specialized workers.

The aim of the present invention is to eliminate the drawbacks described above by providing a modular insulating panel that features quick installation and allows to reduce laying costs.

An object of the invention is to provide a manufacturing method that allows to automatically obtain modular panels of the above mentioned type that have a high quality standard and a low cost.

This aim, this object, and others which will become apparent hereinafter are achieved by a modular insulating panel according to the accompanying claim 1.

According to a further aspect, the invention provides for a method for manufacturing a modular insulating panel of the above mentioned type, in accordance with the accompanying claim 12.

The panel according to the invention reduces laying costs considerably, allowing to achieve coverings that feature perfect mechanical stability, thermal insulation, and soundproofing without having to resort to glueing, mechanical anchoring, and/or sealing operations.

Further characteristics and advantages of the invention will become apparent from the following description of a preferred but not exclusive embodiment of a panel according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional perspective view, taken along a transverse plane, of two identical panels according to the invention, arranged mutually adjacent and coupled to each other on a supporting surface to form an insulating covering;

Figure 2 is a side view of the two panels of Figure 1, disengaged from each other;

Figures 3 and 4 are views of respective further embodiments of the panel of Figure 1;

Figures 5 to 10 are, respectively, schematic views of still further embodiments of a detail of the panel according to the invention.

With reference to the above figures, the modular panels according to the invention are preferably but not exclusively used for the construction of coverings and floorings of a known type.

Figure 1 illustrates a portion of a covering, which shows two modular panels according to the invention that are generally designated by the reference numerals 1 and 1' and are mutually coupled along their edges.

Reference is made, for the description, to panels that have a substantially rectangular plan shape, but this shape may vary and be for example square, hexagonal, circular, et cetera, without thereby abandoning the scope of the invention.

Panel 1 includes a main body 2 formed by at least one layer of rubber or by a mixture of rubber, rubber-cork, and other materials that have insulating properties, in cuttings, with resins and/or binders and fire-retardant substances.

In order to increase the thermal insulation power of the panel, the mixture can include granules of foamed clay, of the "Leca" type, in a proportion that is variable according to the desired final characteristics.

Body 2 of panel 1 has two substantially flat and parallel faces 3 and peripheral edges 4 that allow its coupling in series to other co-planar panels of the same type.

According to a particular characteristic of the invention, edges 4 have a connecting means 5 that is suitable to prevent relative sliding and mutual spacing of panels 1 and 1' along the common plane of arrangement.

Connecting means 5 includes at least one longitudinal protrusion 6 adapted to engage at least one longitudinal recess 7' that is formed correspondingly along the edge of the adjacent panel 1'.

Protrusion 6 and recess 7' are shaped so as to generate, on the coupled panels 1 and 1', opposite lateral forces that are suitable to keep in mutual contact edges 4, 4' of the panels.

By virtue of this configuration, edge 4 of panel 1 has, in a position that is adjacent to protrusion 6, a recess 7 that is identical and symmetrical with respect to recess

7' formed on panel 1'. Likewise, edge 4' of panel 1' has a protrusion 6', in a position that is adjacent to recess 7'. Protrusion 6' is identical and symmetrical with respect to protrusion 6 of panel 1. In this manner, it is possible to couple edges 4 and 4' of the respective panels 1 and 1' regardless of their orientation.

More specifically, in a first embodiment, shown in Figure 1, protrusion 6 is substantially continuous along the entire perimeter of the panel and includes an end portion 8, which is substantially perpendicular to faces 3 of the panel, and an intermediate connecting portion 9, which is substantially parallel to faces 3.

Preferably, the average thickness $\underline{s}$ of protrusion 6 is approximately equal to half of the maximum thickness S of the panel. In this manner, by coupling edges 4 and 4' of the two panels 1 and 1', the panels are co-planar and their faces are perfectly aligned and form no steps.

After the mutual connection of the adjacent panels 1 and 1', the respective protrusions 6 and recesses 7 apply a mechanical action that prevents the relative sliding of panels 1 and 1' along the common plane of arrangement and simultaneously provide an excellent and substantially uniform insulation even in the joint regions, without necessarily requiring glueing or filling of the joints.

Advantageously, this configuration of edges 4 and 4' allows to compensate for small errors in the shape and size of the panels, facilitating mutual coupling during installation.

It is noted that, although protrusion 6 is preferably provided directly during the production of panel 1, it can also be formed subsequently, before installation, by mechanically removing a portion of the peripheral edges, without thereby abandoning the scope of the invention.

In further embodiments, shown in Figures 3 and 4, protrusions 6 and recesses 7 can be constituted by discontinuous parts that have, for example, a substantially dovetail plan shape with radiused corners.

The panel according to the invention can include stiffening parts, not shown in the drawings, that are embedded in the base material. These stiffening parts can, for example, be constituted by wires or laminar metallic frames, or by textile fibers, which cooperate with the base material to constitute a composite unit that is substantially self-supporting.

Conveniently, provision is made for impregnating the panel with fire-retardants mixed in with the base material, and/or for covering the surfaces with a film of fire-resistant material.

Another aspect of the invention relates to a method for manufacturing thermally insulating and soundproofing panels of the above described type that includes the following steps:

- preparation of a mixture of rubber, cork, foamed clay, and similar materials in cuttings, with resins and/or binders and/or fire-retardants;
- preparation of a mold whose shape is suitable to obtain the connecting means along the edges of the panel;
- placing, in the mold, a uniform layer of the mixture that has a controlled thickness;
- closing and heating the mold until an at least partial crosslinking of the resins and the possible vulcanization of the rubber are achieved.

As an alternative, provision is made for depositing in the mold, prior to closure, an additional unitary layer of rubber in the crude state to obtain a panel in which at least one face is impermeable to liquids and highly wear-resistant.

The base material is mixed and deposited in the mold with automatic machines to achieve uniformity in the composition of the panel, a substantially uniform thickness, and a mass per unit volume that is substantially constant in every point.

This method allows to obtain a panel with high-level insulating characteristics that is easy to install and offers perfect mechanical stability, thermal insulation, and soundproofing.

The panel according to the invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept expressed in the accompanying claims. All the details may furthermore be replaced with technically equivalent ones without thereby abandoning the scope of the invention.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Thermally insulating, shock-absorbing, and soundproofing modular panel, particularly for constructions, comprising a main body (2) formed by at least one layer of cuttings made of rubber, rubber-cork, and/or foamed clay and/or similar materials, and substantially flat faces (3) and substantially straight peripheral edges (4) for mutual coupling with other adjacent co-planar panels (1') of the same type, characterized in that said peripheral edges (4) have a connecting means (5) that is suitable to prevent the mutual spacing of the panels (1, 1') on their common plane of arrangement.

2. Panel according to claim 1, characterized in that said connecting means (5) comprises, on each panel, at least one longitudinal protrusion (6) that is suitable to engage in a longitudinal and complementarily

shaped recess (7') that is formed along the edge (4') of an adjacent panel (1').

3. Panel according to claim 2, characterized in that said longitudinal protrusion (6) and said recess (7') are shaped so as to generate, on adjacent panels (1, 1'), upon their coupling, opposite transverse forces that are suitable to keep the edges (4, 4') of said panels in mutual contact and with perfect insulation.

4. Panel according to claim 2, characterized in that the average thickness (s) of said protrusion (6) is approximately equal to half of the maximum thickness (S) of said main body (2).

5. Panel according to claim 2, characterized in that said protrusion (6) has an end portion (8) that lies substantially at right angles to the faces (3) and an intermediate portion (9) that is substantially parallel to said faces (3).

6. Panel according to claim 2, characterized in that said protrusion (6) and said recess (7') are substantially continuous.

7. Panel according to claim 2, characterized in that said protrusion (6) and said recess (7') are constituted by discontinuous parts that are uniformly distributed respectively along the edges (4, 4') of the panels (1, 1').

8. Panel according to claim 7, characterized in that said discontinuous parts have a substantially dovetail plan shape, with sharp or radiused corners.

9. Panel according to claim 1, characterized in that said main body (2) comprises stiffening parts that are embedded in the base material, so as to constitute a substantially self-supporting unit.

10. Panel according to claim 9, characterized in that said stiffening parts are constituted by natural or synthetic flexible fibers and/or by rigid or semirigid wire and/or laminar frames.

11. Panel according to claim 1, characterized in that said main body (2) comprises at least one second unitary layer of vulcanized rubber that faces said at least one layer of cuttings, to make said panel impermeable to liquids on at least one of the faces (3).

12. Method for providing thermally insulating and soundproofing panels according to one or more of the preceding claims, characterized in that it comprises the following steps:

-- preparation of a mixture of rubber, cork, foamed clay, and similar materials in cuttings, resins and/or binders and/or fire-retardants;

-- preparation of a mold whose shape is suitable to form said connecting means along the edges of the panel;

-- placement, in said mold, of a uniform layer of said mixture that has a controlled thickness;

-- closure and heating of the mold until an at least partial crosslinking of the resins and the possible vulcanization of the rubber are achieved.

13. Method according to claim 12, characterized in that it provides for the deposition of at least one further layer of rubber in the crude state prior to the closure of said mold.

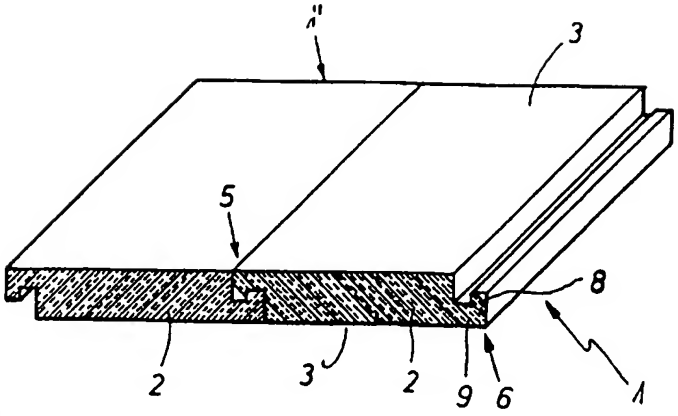

FIG. 1

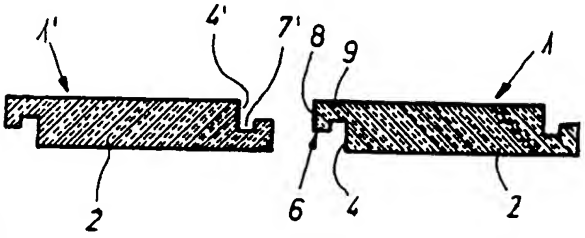

FIG. 2

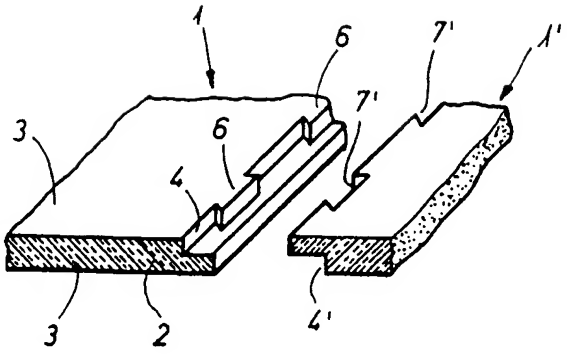

FIG. 3

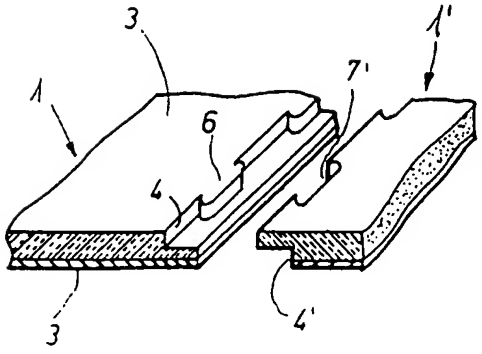

FIG. 4

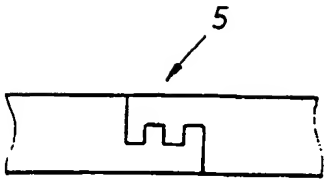

FIG. 5

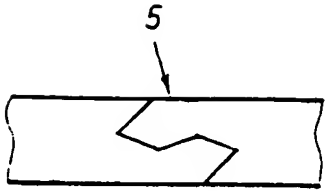

FIG. 6

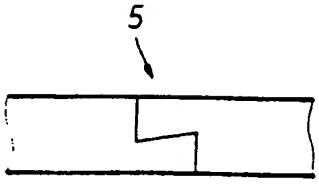

FIG. 7

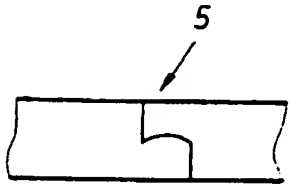

FIG. 8

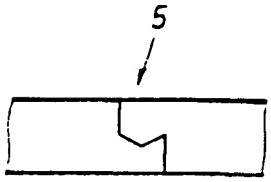

FIG. 9

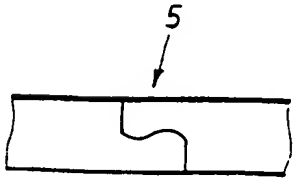

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 8666

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US-A-4 287 693 (COLLETTE) * column 1, line 10 - line 34 * * column 2, line 42 - column 3, line 2; figures * ---	1-3,7,8 4-6,9-11	E04F15/02 E04F15/10 E04B1/90 E04B1/61
X Y A	WO-A-91 15631 (GUMMIWERK KRAIBURG DEVELOPMENT GMBH) * page 14, line 9 - page 16, line 37 * * figures 6,7,11 * ---	12,13 11 1	
Y A	FR-A-2 568 295 (MANON) * page 2, line 8 - page 3, line 20; figures * ---	4-6 11	
Y A	US-A-5 052 158 (D'LUZANSKY) * column 4, line 21 - line 63 * * column 7, line 36 - line 63; figures 1-4,9 * ---	9,10 1-3,7,8, 11	
A	DE-A-17 20 116 (GEBBERT) * the whole document * ---	1,9,10, 12	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E04B E04F
A	GB-A-2 057 354 (WHITMORE NORTHWAY (HOLDINGS) LTD) * column 1, line 13 - line 28 * ---	1,11	
A	DATABASE WPI Week 7834 Derwent Publications Ltd., London, GB; AN 7861499 & JP-A-53 083 315 (HITACHI CHEMICAL KK) , 22 July 1978 * abstract * ---	1	
A	GB-A-1 458 257 (WESTHOFF) * page 1, line 34 - page 2, line 3 * --- -/--	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 March 1996	Porwoll, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 8666

DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DATABASE WPI Week 8843 Derwent Publications Ltd., London, GB; AN 88302645 & JP-A-63 221 008 (OSHIKA SHINKO KK) , 14 September 1988 * abstract * ---	12	
A	DE-A-16 58 875 (HEBGEN) ---		
A	DE-A-40 02 547 (THERMODACH DACHTECHNIK GMBH) ---		
A	DE-A-41 01 322 (FLICKER) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)

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